REMARKS:

Substitute Specification

Applicants hereby submit the substitute specification attached at Tab A. The corrections made to the specification are to correct grammatical inconsistencies and improve syntax and thus believed to include no new matter. To comply with 37 C.F.R. §1.125(b)(2), Applicants also submit a marked-up copy of the substitute specification attached at Tab B showing the matter being added to and the matter being deleted from the specification of record.

The undersigned attorney hereby certifies that the substitute specification includes no new matter.

Amendment to the claims

Examiner Thong H. Vu is thanked for the courtesy of an interview extended to Applicants. The interview was held on July 14, 2004, at which Hirohisa Yamada, a manager of the Intellectual Property Department of NTT DoCoMo, Inc., and Tadashi Horie, an attorney of record from Brinks Hofer Gilson & Lione, personally appeared to meet with Examiner Vu.

In the Office Action, claims 22-57 were rejected under 35 U.S.C. 102(e) as being anticipated by Kimura et al. To overcome the rejection, Applicants have amended the claims as noted in the above amendment. Applicants hereby submit that the amended claims should be patentable over the cited references.

In claim 22 as amended above, the present invention is drawn to a method for relaying application data between a mobile station and a content provider server. The application data is relayed at a mobile packet communication network. As recited in amended claim 22, a packet communication link is first established. An establishment of the packet communication link is initiated by a reception of a packet communication registration request sent from the mobile station. The packet communication registration request includes an originator ID of the mobile station, based on which the

mobile station is identified. In the embodiment, identification is conducted in order to determine whether or not the mobile station is a registered service subscriber.

If the mobile station is successfully identified, the packet communication link is established between the mobile station and the mobile packet communication network. The established packet communication link implements packet communications between the mobile station and the mobile packet communication network. In the embodiment, this packet communication link is established through the bottom three layers illustrated in Fig. 2. In Fig. 2, on the left hand side of the gateway server (GWS) is a wireless telephone network. On the right side thereof, the GWS is connected to a content provider server (CPS) through a public data communication network, such as the Internet. The bottom three layers in the wireless telephone network are dedicated to implementing packet communications within the network.

Since it is a telephone network, each mobile station is uniquely identified by an originator ID or a telephone number. Also, a communication protocol used in the network is fixed. Therefore, there is no need for the mobile station and the mobile communication network to negotiate to determine a communication protocol to be used. Also, there is no need for the mobile station to obtain an IP address for communication with the mobile communication network because the mobile station is uniquely identified by its originator ID in the mobile packet communication network. In fact, as shown in Fig. 4, all necessary to establish the packet communication link is a packet communication registration request from the mobile station.

Returning to claim 22, after the packet communication link is established, the mobile station may access the content provider server. For this purpose, a logical communication connection is established over the packet communication link. In the embodiment, the steps for establishing the logical communication connection are illustrated in Fig. 5. In Fig. 5, the mobile station sends a packet, using the just established packet communication link, to the mobile packet communication network. Please note that the logical communication connection is established between the mobile station and the mobile communication network.

The packet from the mobile station for use in establishing the logical communication connection includes a connection setup request, the header structure of which is illustrated in Fig. 8. There are a couple things to note about the connection setup request. First, the header thereof includes a logical number, which is used to identify a logical connection. The header does not include any port numbers that are usually used in TCP/IP connection. Also, the URL of the content provider server is included in the data field of the connection setup request.

Returning to Fig. 5, after the logical communication connection is established, a TCP/IP connection is established between the mobile packet communication network and the content provider server. The connection is an ordinary TCP/IP connection that follows the OSI seven-layer model. The procedures for setting up the TCP/IP connection are illustrated in Fig. 15. In Fig. 15, an LCP negotiation first takes place. As known by one of ordinary skill in the data communication field, the LCP negotiation takes place in the PPP establishing process to determine, among other things, a communication protocol to be used. After the LCP negotiation finishes, an IPCP negotiation will follows. As known by one of ordinary skill in the data communication field, the IPCP negotiation is a preparation for establishing an IP connection and includes an exchange of information such as the IP addresses of a source and a destination.

As shown in Fig. 4, the procedures for establishing the packet communication link do not have either an LCP negotiation or an IPCP negotiation. As discussed above, the present invention contemplates its application in a mobile packet communication network in which each mobile station is uniquely identified by a pre-assigned ID, such as a telephone number, and the communication protocol used is fixed and has no room for negotiation. Besides, the destination address is identified by its URL, which is stored in the data field of the connection setup request. Therefore, in the present invention, neither the LCP negotiation nor the IPCP negotiation is needed. As a result, as shown in Fig. 7, in the present invention, a transport of application data requires only a TL header, such as shown in Fig. 8 and does not require the conventional PPP

header, the conventional IP header or the conventional TCP header. (See paragraphs 80 and 81 of the substitute specification).

On the other hand, there is nothing in Kimura that discloses or teaches the present invention. First of all, Kimura treats HDLC as a black box and silent about how it works, namely, whether or not there should be an LCT negotiation or an IPCP negotiation. Also, as shown in Fig. 6, the header attached to data which is sent from the HDLC node 1a to the protocol converter 3a includes a destination address DA and an source address SA, which are not included in the header according to the present invention. Also, there is nothing in Kimura that discloses or suggests the logical number that is used in the present invention to identify an established logical communication connection.

For the reasons set forth above, the claim 22 as amended is not anticipated by Kimura et al and should be patentable. Since claim 22 should be patentable, its dependent claims should also be patentable.

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~~COMMUNICATION CONTROL METHOD, COMMUNICATION METHOD, SERVER APPARATUS, TERMINAL DEVICE, RELAY APPARATUS AND~~ COMMUNICATION SYSTEM FOR MOBILE DEVICES

BACKGROUND OF THE INVENTION

TECHNICAL FIELD

The present invention relates to a ~~communication control method, communication method, server apparatus, terminal device, relay apparatus and~~ communication systems and more particularly to a communication system suitable for use in an information ~~distributing~~ distribution system providing information from at least one server apparatus to a plurality of user terminals via a network.

BACKGROUND ART

The ~~i~~Internet provides content providers with an environment capable of ~~providing~~ delivering content to users around the world directly and at a low cost,~~.~~ In addition, the Internet ~~and~~ provides users an environment that allows ~~enabling~~ content from around the world to be enabled for use ~~used~~ in a standard user interface. ~~Along with the popularization of the internet, r~~Recent years ~~have seen active~~ As development, provision and use of content providing services that make~~ing~~ use of the ~~i~~Internet become more prevalent~~active~~, ~~and~~ the vast amount of content available ~~for various uses~~ on the ~~i~~Internet ~~is~~ increases~~ing~~ daily. As a result, the ease of access to the ~~i~~Internet has become an important consideration in the development of content distribution ~~distributing~~ services.

With the ~~spread~~ increasing popularity of the

~~i~~Internet, transparent system architectures employing internet technologies with in LANs (Local Area Networks) have become commonplace. ~~Here,~~ ~~o~~One basic constituent of many "~~i~~Internet technologies" is the communication protocol, specifically TCP/IP (Transmission Control Protocol / Internet Protocol). ~~That is,~~ In fact, a ~~very~~ large number of networks currently employ ~~the~~ TCP/IP.

Data communications according to TCP/IP are based on an OSI layer model (OSI Reference Model). The OSI reference model is a seven layer model used to model data relayed between a transmitter and a receiver. ~~wherein,~~ ~~o~~On the transmission side, data is relayed by sequentially ~~subsequently~~ adding headers for each layer ~~on~~ to actual data from a higher layer ~~to a lower layer, and~~ to form packets. The packets are transmitted to the reception side. ~~On the other hand, a~~At the reception side, the transmitted packets are ~~handed~~ processed sequentially ~~subsequently~~ from the lowest ~~physical~~ layer (physical layer) ~~in order~~ to the highest layer. During processing ~~this procedure,~~ in each layer, packets supplied from a lower layer are separated into data and a header corresponding to that layer,~~.~~ ~~t~~The content of ~~this~~ the header is analyzed, and the data is handed to a next higher layer.

An example of the ~~Here, the~~ packet structure obtained by the processing in each layer on the transmission side shall be explained with reference to Figs. 12-14. ~~However, it shall here be assumed that, as in general dial-up connections,~~ In this example, the transmission side and reception side are connected one-to-one using a PPP (Point-to-Point Protocol)~~.~~, as in general dial-up connections.

Fig. 12 shows the structure of ~~a~~ an example TCP segment which is a packet that has undergone processing in the fourth layer (transport layer). ~~This~~ The TCP segment

is composed of a TCP header and data. ~~Here, the~~ The TCP header is composed of a basic header (20 bytes) and an optional header. The basic header includes information such as a source port number, destination port number, sequence number, acknowledgment number, code bits and window size. Additionally, the data is composed of actual data and a header added by ~~means of~~ processing ~~of~~ at an upper layer equal to or higher than the fifth layer (session layer).

Fig. 13 shows the structure of an example IP datagram which is a packet that has undergone processing in the third layer (network layer). ~~This~~ The IP datagram is composed of an IP header and data. ~~Here, the~~ The IP header is composed of a basic header (20 bytes) and an optional header. The basic header includes information such as a source IP address, a destination IP address, a service type, a packet length, and a protocol number. Additionally, the data is composed of actual data and a header added by processing ~~at least~~ on a elayer equal to or higher than the fourth layer (transport layer) ~~of an upper layer~~ (such as TCP, UDP (User Datagram Protocol) or ICMP (Internet Control Message Protocol). ~~) including at least one layer equal to or higher than the transport layer~~.

Fig. 14 shows the structure of an example PPP frame which is a packet that has undergone ~~the~~ processing ~~of~~ in the second layer (data link layer). The numbers in parentheses in ~~the drawing~~ Fig. 14 are given in units of bytes. ~~This~~ The illustrated PPP frame consists of a PPP header (5 bytes), data, and a PPP footer (3 or 5 bytes). ~~Here, the~~ The PPP header ~~is composed of various information such as~~ includes a flag, an address, a control, and a packet protocol identifier such as ~~(~~LCP (Link Control Protocol~~)~~), IPCP (Internet Protocol Control Protocol), IP

or IPX (Internetwork Packet Exchange)~~)~~. ~~Additionally~~In addition, the data ~~is composed of~~ includes actual data and a header (including the above-mentioned TCP header and IP header) added by processing ~~at a layer including~~ at least one layer equal to or higher than the third layer (network layer). The PPP footer ~~is composed of~~ includes an FCS (Frame Check Sequence) and a flag. The MTU indicated in Fig. 14 ~~the drawing~~ refers to the maximum transmission unit.

As described above, on the transmission side, the actual data to be transmitted is processed by procedures corresponding to each layer in the OSI layer model from the highest layer to the lowest layer. As such , ~~so that~~ a header corresponding to the processing of each layer is sequentially added to the actual data.

~~In~~ Fig. 7 illustrates an example ~~, 7A is a~~ packet 7A that has undergone all of ~~these~~ the processes on the transmission side and ~~finally~~ is ready to be transmitted. ~~,~~ As ~~such that, as~~ shown in Fig. 7 ~~the drawing~~, the packet 7A has a header composed of a 5-byte PPP header, a 20-byte IP header and a 20-byte TCP header. ~~for a~~ The header ~~with~~ therefore includes a total of 45 bytes that are added ~~to the head~~ at the beginning of the application data (if it is assumed that there are no optional headers) ~~,~~. In addition, ~~and~~ a 3- or 5-byte footer is added ~~to the tail~~ at the end of the application data. The size of the application data is, for example, 500 bytes and can be expanded to a maximum of 1460 bytes.

~~Next, the~~ The operating sequence for ~~the case of~~ performing packet communications according to TCP/IP shall now be explained with reference to the example process flow diagram of Fig. 15.

~~First,~~ At S1, an LCP set up request message requesting set up of the LCP ~~(LCP set up request)~~ is sent

from the data transmission side to the data reception side, or from the data reception side to the data transmission side. ~~(S1). Next, an~~ An acknowledgment response message (LCP Set Up Ack) ~~with respect~~ corresponding to the LCP set up request~~,~~ is then sent from the party receiving the LCP set up request message to the other side ~~(S2).~~ at S2. At S3, ~~Subsequently,~~ a Challenge Message to ~~for~~ perform~~ing~~ identification at the other side is subsequently sent from the data reception side. ~~(S3), and upon~~ Upon receipt of ~~this~~ the challenge message on the data transmission side, a response message is sent out ~~(S4)~~ at S4. ~~Then, a~~ At S5, a Success Message to ~~the effect~~ indicate that the identification on the other side has succeeded is then sent out from the data reception side to the data transmission side. ~~(S5).~~

Once this sequence of operations is completed~~,~~, an IPCP set up request message is sent from the data reception side to the data transmission side at S6 ~~(S6)~~. ~~Furthermore~~In addition, an IPCP set up request message is sent from the data transmission side to the data reception side at S7~~(S7)~~.

~~Then~~At S8, an IPCP set up request message or a negative response message (Nak) is sent from the data reception side to the data transmission side ~~(S8)~~. Upon ~~receiving this, an acknowledgment response message with respect to the~~receiving the IPCP set up request message, an acknowledgement response message (IPCP Set Up Ack) is sent from the data transmission side ~~(S9)~~ at S9.

~~Then, this time~~ At S10 an IPCP set up request message is then sent from the data transmission side to the data reception side ~~(S10)~~. Upon receiving ~~this~~ the IPCP set up request message, an acknowledgment response message ~~with respect to this IPCP set up request~~ is sent from the data

reception side at S11 ~~(S11)~~.

~~———~~In this way, a PPP link is established between the data transmission side and the data reception side.

~~Next,~~ At S12, an IP + TCP Request ~~a~~ message ~~(IP + TCP Request)~~ requesting establishment of an IP data link and establishment of a TCP connection is then sent from the data transmission side to the data reception side ~~(S12)~~. ~~When~~ Upon receipt of the IP + TCP request message, an IP + TCP acknowledgment response message ~~with respect to this message~~ is sent from the data reception side at S13. At S14, the data transmission side receives the IP + TCP acknowledgement response message and ~~(S13), the data transmission side upon receiving this~~ sends out a reply ~~an~~ IP +TCP acknowledgment response message ~~to the effect~~ indicating that ~~this~~ the IP + TCP acknowledgment response message has been received ~~(S14)~~.

~~———~~In this way, a TCP connection is established between the data transmission side and the data reception side. ~~,~~ ~~and the~~ The transmission and reception of actual data in the form of packet data is then initiated. ~~as described below.~~

~~First, when packet~~ Packet data is first transmitted from the data transmission side by means of HTTP (HyperText Transfer Protocol) at S15. ~~(S15),~~ At S16, the data reception side, ~~upon receiving~~ receives the packet data and~~this,~~ sends out an acknowledgment response message. ~~(S16).~~ ~~—~~Then, ~~in accordance with the~~ depending on the size of the data being transmitted (e.g. the number of packets needed), the operations of ~~steps~~ S15 and S16~~, i.e. the operations of transmitting the packets and sending back to the data transmission source an acknowledgment response message to the effect that the packets have been received without problems~~ are repeatedly performed until ~~, and~~ the

transmission of the packet data is ~~ultimately~~ completed ~~(S17)~~.

~~When~~ At S17, a transmit finish message indicating ~~to the effect~~ that the transmission of the packet data has been completed is sent out from the data transmission side~~,~~. The ~~the~~ data reception side, upon receiving the transmit finish~~data completed~~ message, ~~which has received this~~ sends out an acknowledgment transmit finish ~~response~~ message at S18. ~~(S18). Then, this time~~ At S19 a reception complete message ~~to the effect~~ that the reception of data has been completed is sent out from the data reception side. ~~, upon~~ Upon receipt of the reception complete message, ~~which~~ the data transmission side sends out an acknowledgment reception complete ~~sponse~~ message at S20.

In this way, the TCP session is ~~terminated.~~

~~Next, in At~~terminated. At S21, to disconnect ~~disconnecting~~ the PPP link, a Terminatione~~-~~ Request message requesting termination of the PPP link ~~(Terminate Request)~~ is sent out from the data transmission side ~~(S21)~~. Upon receiving the termination request message ~~this~~, an acknowledgment termination request ~~response~~ message is sent from the data reception side at S22 ~~(S22)~~.

~~In this way, the~~ PPP ~~TCP~~ link is first disconnected. ~~, and upon~~ Upon disconnection of the PPP link, the channel is disconnected ~~cut off~~ at S23 ~~(S23)~~ and the overall operation is completed.

In recent years, mobile communications have spread widely, and mobile data communications using mobile terminals is increasing~~rising~~ ~~should also see a rise~~ in popularity. In the field of mobile data communications, it has become possible for a mobile user to access the ~~internet~~ Internet using a mobile terminal~~,~~. ~~and~~ the~~Accordingly,~~ provision ~~of~~ for user-friendly ~~internet~~

Internet access services for mobile users is ~~has been~~ desired. ~~However, when providing~~ Providing such mobile Internet ~~internet~~ access services using packet communications according to TCP/IP as described above, however, creates ~~undesireable~~ undesirable performance and operability issues. ~~—the problems mentioned below arise, making them as difficult to handle as mobile stations (portable telephones), and mobile termin als capable of readily accessing the internet did not exist .~~

~~First, with~~With TCP/IP, as described above, the header of a packet is added sequentially by each ~~the~~ layer and encapsulated. ~~, as~~ As a result, ~~of which~~ the overall header size becomes ~~extraord inarily~~ large. ~~, and particularly~~ The header size is particularly large in comparison to the data when the actual data size is small, ~~the relative header size becomes large.~~ For example, when transferring about 500 bytes of data during mobile communications, the header size ~~comes to~~ is about ten percent of the data size. ~~, and there are fields among~~ Among the information contained in the header there are also fields which are left ~~absolutely~~ unused. ~~in actuality.~~

~~Next, there is a problem in that t he~~ The number of signals exchanged between the data transmission side and reception side using TCP/IP is also relatively ~~extremely~~ large in the operating sequences during establishment of connections prior to actually transmitting ~~the~~ data. In the example shown in Fig. 15, a total of 14 steps from ~~step~~ S1 to S14 are performed ~~required~~. Consequently, as the number of users accessing a ~~the~~ network increases, ~~the~~ network traffic increases dramatically and the data transfer rates may drops. In addition, ~~Additionally,~~ since the mobile user is charged for

the operations (steps S1-S14) prior to data transmission and reception, the economic burden on the mobile user ~~side~~ may also becomes~~ large.

Although these ~~problems~~ processes also occur in connections to the ~~internet~~ Internet via fixed networks, they are especially burdensome ~~serious problems~~ in mobile ~~communications~~ communication where ~~wherein the~~ data transmission ~~ability~~ capability (e.g. bandwidth) is relatively low in comparison to communications~~-~~ via fixed networks.

~~Additionally~~In addition, since ~~the~~ TCP/IP is relatively complex~~too heavy~~, ~~it makes the~~ mobile terminals with ~~available~~ computing capability ~~having the ability~~ to rapidly process ~~the~~ TCP/IP may~~ust~~ be larger, heavier, and more expensive. ~~than the mobile station, when installing devices with the ability to process data to the level of mobile stations.~~ Currently, ~~such the large, heavy and expensive~~ mobile terminals with rapid processing capability (such as a personal digital assistant (PDA), etc.) ~~which~~ simply include~~tegrate~~ a portable computer ~~with a mobile station~~ and are therefore received well only in small markets. In contrast, mobile stations that are used for voice communication are ~~stations are~~ designed ~~with~~ for portability, operability and ease of use. The ~~obtainment in mind, and the~~ form and price of mobile stations for voice communication are believed to ~~be~~ already be well-received in ~~an extremely~~ a broad market due to their general usefulness and high degree of popularity.

~~Additionally, as~~

As mentioned above, various types of content capable of ~~responding to~~ meeting the needs of various users already exists on the Internet. ~~internet, and due~~ Due ~~-~~to the steady increase in the amount of content, ~~even now,~~ devices

~~which~~ that are already operated ~~capable of being accepted~~ by various users such as mobile stations for voice communication are desired as devices for accessing the ~~internet~~Internet. ~~Keeping With these points matters in mind, there is little doubt probability~~Thus, ~~that~~ services for accessing the Internet ~~internet~~ using mobile ~~terminals~~ stations for voice communication that have~~ing~~ the ~~ability~~ capability to rapidly process TCP/IP will be well-received in a wide market. Even ~~, even~~ without taking into consideration the problem of data transmission ~~ability~~ capability in mobile communications.

~~Of course, one~~ One might also consider having the content providing side develop content ~~which~~ that is customized to the data processing power of mobile stations for voice communication, and/or the data transmission capability~~ability~~ of mobile communications. The ~~, but this type of~~ development of this type of customized content may place~~requires~~ a heavy burden ~~of~~ on the content providing side. ~~, and~~ Accordingly, it is predicted that only a small amount of content with uses that are restricted to mobile stations for voice communication as compared to the content of the ~~internet~~ Internet will be available ~~able to be provided~~ to the user. ~~That is, it is believed that this type of experiment would only be well-received in a small market.~~

From the above description, it is believed that the foundation of mobile data distribution is in the combination of mobile stations with voice communication with the Internet. In ~~internet, and in~~ order to achieve this combination, it is necessary to develop efficient communication technologies which enable mobile users to effortlessly ~~stresslessly~~ use content from the Internet ~~internet~~ using mobile stations with voice communication.

SUMMARY OF THE INVENTION

The present invention has been made in view of the above-mentioned problems, and has the object of providing a communication control method, communication method, server apparatus, terminal device, relay apparatus and communication system capable of efficiently performing data communications even when the data processing capability ~~ability~~ and transmission capability ~~ability~~ are not high such as in mobile stations.

In order to achieve the above purpose, a communication control method recited in claim 1 is a communication control method in a relay apparatus for relaying data communications between a server apparatus and a user terminal. The method comprises ~~, comprising a step of~~ receiving a packet that includes ~~containing~~ a request message to request ~~requesting~~ establishment of a connection with the server apparatus and an identification number for the connection. The request message is sent from the user terminal according to a first communication protocol.

The method also includes ~~which is a protocol; a step of~~ transmitting a packet containing an acknowledgment response message ~~that the packet has been received~~ to the user terminal according to the first communication protocol. The acknowledgement response message is indicative that the request message has been received by the relay apparatus. In addition, the method includes ~~, and~~ establishing a connection between the server apparatus and the relay apparatus ~~itself~~ according to a second communication protocol, wherein the first communication protocol is simpler than the second communication protocol.

The method further includes ~~; a step of~~ receiving a

packet containing a data transfer request message transmitted from the user terminal to the server apparatus according to the first communication protocol, and transmitting a packet containing the ~~this~~ data transfer request message to the server apparatus according to the second communication protocol. In addition, the method ~~includes; and a step of receiving~~ includes receiving data transmitted from the server apparatus according to the second communication protocol and transmitting a packet containing ~~this~~ the received data to the user terminal according to the first communication protocol. ~~Here, the first communication protocol is simpler than the second communication protocol.~~

According to this communication control method, a conversion is made between a second communication protocol with a server apparatus and a first communication protocol with a user terminal. The first communication protocol ~~which~~ is simpler than the second ~~this~~ communication protocol. The second communication protocol may be used to directly ~~relay when relaying client~~ relay client/server type data communications between a user terminal and a server apparatus. Consequently, according to this communication control method, at least one of the following is achieved on the user terminal side: a reduction of the size of the headers ~~header~~ in the packets, a reduction in the ~~of~~ number of messages (signals) exchanged, and a reduction in ~~of~~ processing at the user terminal. Accordingly, ~~thereby enabling~~ the processing load on the user terminal side ~~to be~~ is lightened.

~~—~~In particular, ~~since~~ much of the message content exchanged over the Internet ~~internet~~ is text data. In ~~and in~~ the transmission of text data according to TCP/IP, the proportion of actual data in the transmitted packets is low.

When ~~, so that when~~ considering connections to the Internet~~internet~~, the reduction of the headers in the packets is extremely effective.

Additionally, a communication control method recited in claim 2 is a communication control method in a relay apparatus for relaying data communications between a server apparatus and a user terminal. The method comprises ~~, comprising a step of~~ receiving a packet that includes ~~containing~~ a request message ~~requesting~~ to request establishment of a connection with ~~to~~ the server apparatus, an identification number for the connection and a data transfer request message for the server apparatus. The request message is transmitted from the user terminal according to a first communication protocol.

The method also includes ~~, a step of~~ transmitting a packet containing an acknowledgment response message ~~that the packet has been received~~ to the user terminal according to the first communication protocol. The acknowledgement response message~~thod~~ indicates that the request message has been received by the relay terminal. ~~,~~ In addition, the method includes establishing a connection between the server apparatus and ~~itself~~ the relay terminal according to a second communication protocol.

The method further includes ~~, and~~ transmitting a packet containing the data transfer request message to the server apparatus, ~~, and a step of~~ receiving data transmitted from the server apparatus according to the second communication protocol and transmitting a packet containing ~~this~~ the received data to the user terminal according to the first communication protocol. ~~Here, the~~ The first communication protocol is simpler than the second communication protocol.

According to this communication control method, it is

possible to include a connection establishment request to the server apparatus and a data transfer request in a single message (signal) from the user terminal to the relay apparatus. As a result, ~~according to this communication control method,~~ the traffic between the user terminal and relay apparatus can be reduced and data transfer requests can be sent ~~out~~ to the relay apparatus without the user terminal waiting for acknowledgment response messages from the relay apparatus. ~~at the user terminal, in~~ In addition, methods similar to those previously discussed with regard to claim 1 are also described. ~~to the effects of the invention recited in claim 1.~~

A communication control method recited in claim 3 is the ~~a~~ communication control method according to claim 1 or 2, wherein the number of messages~~thod~~ (signals) used in establishing the connection between the user terminal and the relay apparatus according to the first communication protocol is less than the number of messages ~~signals~~ used in establishing the connection between the relay apparatus and the server apparatus according to the second communication protocol.

~~———~~According to this communication control method, it is possible to reliably reduce the number of messages ~~signals~~ exchanged by the user terminal when establishing a connection, in addition to the method ~~effects due to the invention~~ recited in claim 1 or 2.

A communication control method recited in claim 4 is the ~~a~~ communication control method according to claim 1 or 2, wherein a communication ~~interval~~ path between the user terminal and the relay apparatus ~~,~~ is composed of a wireless communication path. A ~~of a radio oriented interval, and a~~ communication ~~interval~~ path between the relay apparatus and the server apparatus, on the other hand, is composed of a

wireline communication path ~~a wire oriented interval~~.

According to this communication control method, communications by a wireless communication protocol that is simpler than the communication protocol in wireline communications is ~~a wired interval are~~ performed over a wireless communication paths~~.~~ As previously discussed, wireless communications ~~in a radio interval which~~ generally have ~~has~~ a lower data transmission capacity than wireline communications ~~the wired interval~~. Therefore, according to this communication control method, the effect of being able to achieve communications suited to the data transmission capabilities of each ~~interval~~ path is obtained in addition to the method ~~effects according to the invention~~ recited in ~~claim~~ claims 1 or 2.

A communication method recited in claim 5 is a communication method for performing data communications between a server apparatus and a user terminal, wherein a communication control procedure in an upper layer includes ~~containing~~ a transport layer in the data communications. The method comprises ~~a first step of~~ transmitting from the user terminal to the server apparatus a first packet containing a request message to request ~~requesting~~ establishment of a connection and an identification ~~and an identification~~ number for the connection.

~~from the user terminal to the server apparatus; a second step of~~ In addition, the method includes transmitting from the server apparatus to the user terminal a second packet containing an acknowledgment response message indicating that the ~~this~~ first packet has been received. ~~from the server apparatus to the user terminal; and a third step of~~ The method further includes transmitting a third packet containing actual data to the user terminal from the server apparatus by designation of

~~designating~~ the identification number. The third packet is transmitted ~~from the server apparatus~~ after the connection has been established between the user terminal and the server apparatus.

According to this communication method, a connection is established between the user terminal and server apparatus. The connection is established by a communication control procedure of an upper layer that includes ~~containing~~ a transport layer. The ~~, and the~~ transmission of packets containing actual data is performed through the ~~this~~ connection. Consequently, according to this communication method, at least one of the following is achieved on the user terminal side: a reduction in the size of the headers ~~header~~ in the packets, a reduction in the ~~of~~ number of messages ~~signals~~ exchanged and a reduction in ~~of~~ processing. The method therefore ~~allows, thereby enabling the~~allows the processing load on the user terminal side to be lightened.

~~The~~~~Here, the reduction~~The reduction of the processing load on the user terminal side shall now be explained using an example. In this example, ~~in detail.~~

~~For example, a case where~~ the user terminal and server apparatus commence communications using TCP/IP and PPP ~~shall be assumed~~. Using existing TCP/IP and PPP protocols, ~~In this case,~~ there are the following problems~~.~~:

1. The ~~Since the~~ communication protocols of each layer are for general use. Accordingly, the proportion of actual data contained in the transmitted data is extremely small due to encapsulation ~~encapsulating~~ in the layers.
2. Establishment ~~Since establishment~~ procedures are performed for each layer when establishing a connection. Accordingly, a large number of messages ~~signals~~ must be exchanged. ~~, thus increasing~~ Communication traffic is

therefore increased, which ~~and causing~~ causes a ~~great~~ greater processing load on the user terminal.

3. At the user terminal, data encapsulating and decapsulating procedures are performed over multiple stages, thus causing a ~~great~~ greater load on the user terminal.

In contrast, by transmitting packets containing actual data through connections established by the communication control procedures of the upper layers that include ~~containing~~ the transport layer as in the ~~this~~ communication method of claim 5, ~~method~~, it is possible to resolve at least one of the above problems.

~~Additionally, a~~A communication method recited in claim 6 is a communication method for performing data communications between a user terminal and a relay apparatus. The relay apparatus is ~~for~~ relaying data communications between the user terminal and a server apparatus. The ~~, wherein~~ communication control procedure in an upper layer includes ~~containing~~ a transport layer. The method ~~in the data communications~~ comprises ~~a first step of~~ transmitting from the user terminal to the relay apparatus a first packet containing a message requesting establishment of a connection and an identification number for the connection.

~~and an identification number for the connection from the user terminal to the relay apparatus; a second step of~~ The method also includes transmitting from the relay apparatus to the user terminal a second packet containing an acknowledgment response message that ~~this~~ the first packet has been received. ~~from the relay apparatus to the user terminal; and a third step of~~ The method further includes transmitting to the user terminal a third packet containing actual data supplied to the relay apparatus according to a predetermined protocol from the server

apparatus. ~~to the user terminal by~~ The third packet is transmitted by designating the identification number after the connection has been established between the user terminal and the relay apparatus.

According to this communication method, a connection is established between the user terminal and relay apparatus through ~~by~~ communication control procedures performed in ~~of~~ upper layers including the transport layer. ~~, and p~~Packets containing actual data from the server apparatus are transmitted from the relay apparatus to the user terminal through this connection. ~~Consequently, a~~According to this communication method, the same effects as those of the invention recited in claim 5 are obtained. Additionally, ~~according to this communication method,~~ the connection is first established between the user terminal and the relay apparatus. The time the user terminal has to wait to receive ~~, thereby shortening the time until~~ an acknowledgment response message becomes shorter, compared to cases where a connection ~~is received at the user terminal in comparison to the case where one~~ is established between the user terminal and a server apparatus.

Also, a communication method recited in claim 7 is the~~a~~ communication method according to claim 5, wherein in the first packet ~~step~~, the user terminal also transmits, to the server apparatus, data size information. The data size information indicates~~ing~~ the maximum amount (size) of data that the user terminal ~~it~~ is capable of receiving in one packet~~at once to the server apparatus~~.~~; and t~~ The server apparatus obtains the maximum data size information from the first packet received. ~~data size information which has been received, and~~ Based on the maximum data size, the server apparatus divides ~~the~~ actual data for transmission to the user terminal among two or more packets if the size

of the actual data ~~third packet~~ exceeds the maximum data size.

~~According to this communication method,~~ In addition to the ~~effects of the invention~~ method recited in claim 5, ~~it is possible to avoid~~ situations are avoided where the server apparatus sends the user terminal packets of data that are ~~of a size~~ too large ~~enough~~ for the user terminal to ~~not be able to~~ receive ~~in one packet~~ which ~~cannot be received at once by the user terminal, in addition to the effects due to the invention recited in claim 5~~. In other words, transmitted data packets are sized less than or equal to a maximum size of data packets that the user terminal has indicated are capable of receipt by the user terminal.

Furthermore, a communication method recited in claim 8 includes the ~~a~~ communication method according to claim 6, wherein ~~in the first step,~~ the user terminal transmits, to the relay apparatus, data size information indicating the maximum size of data that the user terminal ~~it~~ is capable of receiving in one packet. ~~at once to the relay apparatus; and~~ The relay apparatus obtains the maximum data size information ~~from the received data size information which has been received,~~ and divides the actual data for transmission to the user terminal if the size of the actual data ~~third packet~~ exceeds the maximum size.

According to this communication method, in addition to the ~~effects of the invention~~ method recited in claim 6, ~~it is possible to avoid~~ situations where the relay apparatus sends the user terminal packets of data that are sized larger than the user terminal is able to receive are avoided ~~a size large enough for the user terminal to not be able to receive in one packet which cannot be received at once by the user terminal, in addition to the effects due~~

~~to the invention recited in claim 6~~.

A server apparatus recited in claim 9 is a server apparatus for performing data communications with a user terminal. The server apparatus comprises ~~, comprising~~ communication control means for performing communication control at an upper layer level. The upper layer level ~~that~~ includes ~~containing~~ a transport layer ~~when~~ in order to perform~~ing~~ the data communications. T~~;~~ the communication control means further comprises~~ing~~ means for receiving a first packet containing a connection request message. The connection request message includes a ~~that~~ request~~s~~ing to establish~~ment of~~ a connection with the server apparatus, and an identification number for the connection transmitted from the user terminal.

The communication control means also includes ~~,~~ means for transmitting~~,~~ to the user terminal~~,~~ a second packet containing an acknowledgment response message. The acknowledgement response message indicates that the~~is~~ first packet has been received by the server apparatus. ~~to the user terminal; and~~ The communication control means further includes means for transmitting, to the user terminal, a third packet that includes ~~containing~~ actual data. ~~to the user terminal~~ The third packet may be transmitted by designation~~g~~ of the identification number~~,~~ after the connection has been established with the user terminal.

According to this server apparatus, the communication control is performed at an upper layer level that includes ~~containing~~ the transport layer. With this communication control, a connection is established between the server apparatus and the user terminal. ~~, and p~~Packets containing actual data are transmitted from the server apparatus to the user terminal via the ~~is~~ connection. T~~Consequently,~~ ~~t~~his server apparatus is able to ~~obtain~~ achieve the same

effects as those of ~~the effects due to~~ the invention recited in claim 5.

A relay apparatus recited in claim 10 is a relay apparatus for relaying data communications between a server apparatus and a user terminal. The relay apparatus ~~,~~ comprises~~ing~~ communication control means for performing communication control. The communication control is performed at an upper layer level that includes ~~containing~~ a transport layer in order to ~~when~~ perform~~ing~~ the data communications. ~~; t~~The communication control means further comprises~~ing~~ means for receiving a first packet containing a connection request message. The connection request message ~~that~~ includes a request~~s~~ to ~~requesting~~ establish~~ment of~~ a connection and an identification number for the connection transmitted from the user terminal. ~~;~~

In addition, the communication control means includes means for transmitting~~,~~ to the user terminal~~,~~ a second packet ~~containing~~ includes an acknowledgment response message indicating that this first packet has been received by the server apparatus. Further, the communication control means includes~~; and~~ means for transmitting, to the user terminal, a third packet that includes ~~containing~~ actual data supplied from the server apparatus to the relay apparatus according to a predetermined protocol. The third packet may be transmitted ~~to the user terminal~~ by designation~~ng~~ of the identification number~~,~~ after the connection has been established between the user terminal and ~~itself~~the relay apparatus.

According to this relay apparatus, communication control is performed at the upper layer level that includes~~containing~~ the transport layer. With this communication control, a connection is established between the relay apparatus and the user terminal. ~~through which ,~~

~~and~~ Ppackets containing actual data provided by ~~from~~ the server apparatus are transmitted from the relay apparatus to the user terminal through this connection.

T~~Consequently, t~~his relay apparatus is able to ~~obtain~~ achieve the same effects as those of ~~the effects due to~~ the invention recited in claim 6.

~~Additionally, a~~A relay apparatus recited in claim 11 is a relay apparatus for relaying data communications between a server apparatus and a user terminal. The relay apparatus ~~,~~ comprises~~ing~~ means for receiving a packet containing a connection request message. The connection request message includes a ~~that~~ request~~requesting~~ to establish~~ment of~~ a connection with the server apparatus and an identification number for the connection. The connection request message may be transmitted from the user terminal according to a first communication protocol. The relay apparatus also comprises ~~,~~ means for transmitting ~~,~~ to the user terminal ~~,~~ a packet containing an acknowledgment response message. The acknowledgement response message is transmitted according to the first communication protocol and includes indication that the packet has been received by the server apparatus ~~to the user terminal according to the first communication protocol~~ .~~, and~~

The relay apparatus also includes means for establishing a connection between the server apparatus and the relay apparatus ~~itself~~ according to a second communication protocol. The relay apparatus further~~also~~ comprises ~~,~~ means for receiving a packet containing a data transfer request message. The data transfer request message is transmitted from the user terminal to the server apparatus according to the first communication protocol.

The relay apparatus also includes means ~~, and~~ for transmitting a packet containing the ~~is~~ data transfer

request message to the server apparatus according to the second communication protocol. The relay apparatus further comprises~~; and~~ means for receiving data transmitted from the server apparatus according to the second communication protocol and means for transmitting a packet containing this data to the user terminal according to the first communication protocol.~~; wherein t~~The first communication protocol is simpler than the second communication protocol.

~~According to t~~This relay apparatus performs ~~, a~~ conversion ~~is made~~ between the second~~a~~ communication protocol used to communicate with the~~a~~ server apparatus and ~~a~~the first communication protocol used to communicate with ~~a~~the user terminal. The first communication protocol is ~~which is~~ simpler than the~~is~~ communication protocol that ~~when~~ relays~~ing~~ client/server type data communications between a user terminal and a server apparatus. ~~Consequently, t~~This relay apparatus is able to achieve ~~obtain~~ the same effects as those of the invention recited in claim 1.

Furthermore, a relay apparatus recited in claim 12 is a relay apparatus for relaying data communications between a server apparatus and a user terminal. The relay apparatus~~,~~ comprises~~ing~~ means for receiving a packet containing a connection request message that includes a request~~ing~~ to establish~~ment of~~ a connection to the server apparatus and~~,~~ an identification number for the connection. The means for receiving a packet may also receive ~~and~~ a data transfer request message for the server apparatus transmitted from the user terminal according to a first communication protocol.

The relay apparatus also includes~~,~~ means for transmitting, to the user terminal, a packet containing an acknowledgment response message indicating that the packet

has been received by the server apparatus. The packet containing the acknowledgement response message is transmitted ~~to the user terminal~~ according to the first communication protocol. Means ~~,~~ for establishing a connection between the server apparatus and the relay apparatus~~itself~~ according to a second communication protocol are also included in the relay apparatus.

In addition, ~~and~~means for transmitting a packet containing the data transfer request message to the server apparatus, ~~,~~ and means for receiving data transmitted from the server apparatus according to the second communication protocol are also included in the relay apparatus. The relay apparatus also includes means ~~and~~ for transmitting a packet containing this data to the user terminal according to the first communication protocol. ~~; wherein t~~The first communication protocol is simpler than the second communication protocol.

According to this relay apparatus, ~~it is possible t o include~~ a connection establishment request to the server apparatus and a data transfer request may both be included in a single signal (or message) from the user terminal to the relay apparatus. Therefore, the ~~is~~ relay apparatus is capable of achieving ~~obtaining~~ the same effects as ~~the effects~~those of the invention recited in claim 2.

A relay apparatus recited in claim 13 is a relay apparatus according to claim 11 or 12, wherein the number of signals used for ~~in~~ establishing the connection between the user terminal and the relay apparatus according to the first communication protocol is less than the number of signals used in establishing the connection between the relay apparatus and the server apparatus according to the second communication protocol.

~~———~~ According to this relay apparatus, the number of

signals exchanged at the user terminal when establishing a connection can be reliably reduced in addition to the effects of the invention recited in claim 11 or 12.

A relay apparatus recited in claim 14 is a relay apparatus according to any one of claims 10-12, wherein a communication ~~interval~~ path between the user terminal and the relay apparatus ~~is composed of~~ includes a wireless communication path (radio-oriented interval). In addition, ~~and~~ a communication path ~~interval~~ between the relay apparatus and the server apparatus ~~is composed of~~ includes a wireline communication path (wire-oriented interval).

According to this relay apparatus, the communication procedures in the wireless communication ~~a radio interval~~ path ~~which~~ generally have~~s~~ a lower data transmission capacity than ~~a~~ the wireline communication~~d~~ ~~interval~~ path. The communication procedures in the wireless communication path are ~~is~~ reduced to less than the communication processes necessary to achieve communications on ~~in~~ the wireline communication ~~d interval~~path. Consequently, ~~according to t~~This relay apparatus ~~, the effect of being able to~~ achieves communications suited to the data transmission capabilities of each ~~interval~~ communication path, ~~is obtained~~ in addition to the effects of ~~according to~~ any one of claims 10-12.

A communication system recited in claim 15 is characterized in that a user terminal and a server apparatus are connected via a relay apparatus according to any one of claims 10-12.

According to this communication system, the same effects as those ~~effects~~ of any one of claims 10-12 can be achieved~~obtained~~.

A terminal device recited in claim 16 is a terminal device for performing data communications with a server

apparatus. The terminal device ~~,~~ comprises~~ing~~ communication control means for performing communication control on an upper layer level that includes ~~containing~~ a transport layer ~~when~~ in order to perform~~ing~~ the data communications. ~~,~~ ~~the~~ The communication control means comprises ~~ing~~ means for transmitting a first packet that includes ~~containing~~ a connection request message to~~that~~ request~~s~~ing establishment of a connection with the server apparatus, and an identification number for the connection.

The communication control means also includes ~~,~~ means for receiving a second packet containing an acknowledgment response message ~~that the first packet has been received~~ transmitted from the server apparatus. The acknowledgment response message includes indication that the first packet has been received by the server apparatus. ~~; and~~ Mmeans for receiving a third packet containing actual data transmitted from the server apparatus is also included in the communication control means. The third packet may be transmitted by first designating the identification number, after the connection has been established with the server apparatus.

According to this terminal device, communication control is performed at ~~on~~ the upper layer level that includes ~~containing~~ the transport layer. With this communication control, a connection is established between the server apparatus and the terminal device. ~~, and p~~ Packets containing actual data are transmitted from the server apparatus to the terminal device through this connection. ~~Therefore, t~~This terminal device ~~is able to obtain~~may also achieves the same effects as those of the invention recited in claim 5.

The terminal device recited in claim 17 is a terminal device for performing data communications with a server

apparatus via a relay apparatus. The relay apparatus ~~that for~~ manages~~ing~~ a connection with the terminal device. The terminal device~~,~~ comprises~~ing~~ communication control means for performing communication control at ~~on~~ an upper layer level that includes ~~containing~~ a transport layer in order to ~~when~~ perform~~ing~~ the data communications~~.~~ ~~,~~ T~~t~~he communication control means comprises ~~ing~~ means for transmitting a first packet containing a connection request message that includes a request~~ing~~ to establish~~ment of~~ a connection with the relay apparatus and an identification number for the connection.

The communication control means also includes ~~,~~ means for receiving a second packet containing an acknowledgment response message transmitted from the relay apparatus. The acknowledgment response message includes indication that the first packet has been received by the server apparatus. ~~transmitted from the relay apparatus; and m~~ Means for receiving a third packet containing actual data supplied from the server apparatus to the relay apparatus according to a predetermined protocol is also included in the communication control means. The third packet may be ~~and~~ transmitted from the relay apparatus by designating the identification number~~,~~ after the connection has been established between the relay apparatus and itself.

According to this terminal device, communication control is performed ~~on~~ at the upper layer level that includes~~containing~~ the transport layer. With this communication control, a connection is established between the relay apparatus and the terminal device. ~~through which~~ ~~,~~ ~~and~~ Ppackets containing actual data from the server apparatus are transmitted to the terminal device through this connection ~~through this connection~~. Therefore, this terminal device ~~is able to obtain~~ also achieves ~~the~~

~~same~~similar effects as those of the invention recited in claim 6.

The terminal device recited in claim 18 is a terminal device for performing data communications with a server apparatus via a relay apparatus. ~~that for~~ The relay apparatus manages~~ing~~ a connection with the terminal device. The terminal device~~,~~ comprises~~ing~~ means for transmitting a packet containing a connection request message that includes a request to~~sing~~ establish~~ment of~~ a connection with the server apparatus and an identification number for the connection. The packet is transmitted according to a first communication protocol.

M~~; m~~eans for receiving a packet containing an acknowledgment response message ~~that the packet has been received~~ transmitted from the relay apparatus according to the first communication protocol is also included in the terminal device. The acknowledgment response message includes indication that the packet has been received by the server apparatus. The terminal device also includes ~~,~~ means for transmitting a packet containing a data transfer request message to the server apparatus according to the first communication protocol.

M~~; and m~~eans for receiving ~~according to the first communication protocol~~ a packet containing actual data supplied from the server apparatus according to the first communication protocol is also included in the terminal device. The data supplied from the server apparatus is transmitted to the terminal device from the relay apparatus. The ~~to the~~ relay apparatus is supplied data from the server apparatus according to a second communication protocol in response to the data transfer request message. ~~Here, t~~The first communication protocol is simpler than the second communication protocol.

According to this terminal device, a conversion is made at the relay apparatus between the second ~~a~~ communication protocol used to communicate with the~~a~~ server apparatus and the first ~~a~~ communication protocol used to communicate with the~~a~~ terminal device. The first communication protocol ~~which~~ is simpler than the ~~is~~ communication protocol needed to be performed when relaying client/server type data communications between a terminal device and a server apparatus. Therefore, this terminal device is able to also achieve ~~obtain~~ the same effects as those of the invention recited in claim 1.

A terminal device recited in claim 19 is a terminal device for performing data communications with a server apparatus via a relay apparatus. The relay apparatus ~~that for~~ manages~~ing~~ a connection with the terminal device. The terminal device~~,~~ comprises~~ing~~ means for transmitting according to a first communication protocol a packet that includes~~containing~~ a connection request message to~~that~~ requests~~ing~~ establishment of a connection with the server apparatus, an identification number for the connection and a data transfer request message for the server apparatus.

The terminal device also includes ~~;~~ means for receiving a packet containing an acknowledgment response message ~~that this packet has been received transmitted~~ that is transmitted from the relay apparatus according to the first communication protocol. The acknowledgment response message includes indication that the packet was received by the server apparatus. ~~; and m~~ Means for receiving ~~according to the first communication protocol~~ a packet containing actual data supplied from the server apparatus transmitted according to the first communication protocol is also included in the terminal device. The packet containing actual data supplied from the server

apparatus is transmitted to the relay apparatus according to a second communication protocol in response to the data transfer request message. ~~Here, t~~The first communication protocol is simpler than the second communication protocol.

According to this terminal device, ~~it is possible t o include~~ a connection establishment request to the server apparatus and a data transfer request may both be included in a single ~~signal~~ (signal (message) from the user terminal to the relay apparatus. Therefore, this terminal device ~~is able to obtain~~ also achieves the same effects as those of the invention recited in claim 2.

A terminal device recited in claim 20 is the ~~a~~ terminal device according to claim 18 or 19, wherein the number of signals used for ~~in~~ establishing the connection between the user terminal and the relay apparatus according to the first communication protocol is less than the number of signals used for ~~in~~ establishing the connection between the relay apparatus and the server apparatus according to the second communication protocol.

~~———~~ According to this terminal device, it is possible to reliably reduce the number of signals exchanged when establishing a connection, in addition to the effects of the invention recited in claim 18 or 19.

A terminal device recited in claim 21 is the ~~a~~ terminal device according to any one of claims 17-19, wherein a communication ~~interval~~ path between the user terminal and the relay apparatus ~~is composed of~~ includes a ~~radio oriented~~wireless communication ~~interval~~path. In addition, ~~, and~~ a communication ~~interval~~ path between the relay apparatus and the server apparatus ~~is composed of~~includes a wireline communication ~~oriented~~ ~~interval~~path.

According to this terminal device, the communications procedures in a wireless communication ~~radio~~ ~~interval~~ path

~~which~~ generally have~~s~~ a lower data transmission capacity than a wireline ~~communicaiton~~ communication~~d~~ ~~interval~~ path.~~are~~ The communication procedures in the wireless communication path are~~is~~ reduced to less than the communication procedures in the wireline communication ~~d interval~~path. Therefore, according to this termina l device, it is possible to achieve communications suited to the data transmission capabilities of each ~~interval link~~ communication path, in addition to the effects of any of claims 17-19.

~~In summary of the above, t~~The present ~~invention,~~invention ~~since~~ employs~~ing~~ a simplified protocol to~~when~~ perform~~ing~~ data communications between a server apparatus and a user terminal. The simplified protocol, makes the header size smaller and thus ~~in order to~~ reduces the amount of data transferred. In addition the simplified protocol ~~and~~ reduces the number of transmitted messages (signals) when ~~at~~ a channel connection is established ~~by employing a simplified protocol when performing data communications between a server apparatus and a user terminal~~. The present invention ~~,~~ thereby ~~lightening~~reduces ~~the~~communication traffic and ~~reducing the~~resulting ~~overhead,~~overhead and also improves~~ing~~ the response of data communications. Therefore, it enables smooth and speedy downloading of ~~the comfortable use of I~~internet contents~~-~~ with~~using~~ devices having ~~roughly~~ the data processing capabilities of a~~the a~~ mobile device and through wireless ~~a~~ communication channels having relatively ~~a~~ low data transmission capacity.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a block diagram showing the structure of an

example communication system according to an embodiment of the present invention.

Fig. 2 is a block diagram showing an example protocol structure of the ~~same~~ communication system illustrated in Fig. 1.

Fig. 3 is a block diagram showing another example protocol structure of the ~~same~~ communication system illustrated in Fig. 1.

Fig. 4 is a flow diagram showing an example ~~the~~ operating sequence prior to packet communications in the ~~same~~ communication system illustrated in Fig. 1.

Fig. 5 is a flow diagram showing ~~the~~ an example operating sequence during packet communications in the ~~same~~ communication system illustrated in Fig. 1.

Fig. 6 is a flow diagram showing ~~the~~ an example operating sequence after packet communications in the ~~same~~ communication system illustrated in Fig. 1.

Fig. 7 is a table ~~diagram~~ comparing the structure of a packet transmitted in TCP/IP communications and the structure of a packet transmitted according to a simplified protocol T6 ~~in the same embodiment~~.

Fig. 8 is a table ~~diagram~~ showing the structure of an example packet transmitted in a connection set up request ~~in the same embodiment~~.

Fig. 9 is a table ~~diagram~~ showing the structure of an example packet transmitted in acknowledgment response to a connection set up request of Fig. 8 ~~in the same embodiment~~.

Fig. 10 are~~is~~ tables ~~a diagram~~ showing the structure of example~~a~~ packets transmitted during data transmission and reception ~~in the same embodiment~~, showing the structure of a packet containing actual data and showing the structure of a packet transmitted in acknowledgment response when ~~a~~the packet containing actual data has been

transmitted.

Fig. 11 is a diagram showing an example of the outward appearance of a mobile station contained in the ~~same~~ communication system of Fig. 1 and showing a screen of an information display portion when the mobile station is providing the user with information.

Fig. 12 is a table ~~diagram~~ showing the format of an example TCP segment.

Fig. 13 is a table ~~diagram~~ showing the format of an example IP datagram.

Fig. 14 is a table ~~diagram~~ showing the format of ~~a~~ an example PPP frame.

Fig. 15 is a flow diagram showing an example operating sequence for the case in which data communications are performed using TCP/IP.

Fig. 16 is a block diagram showing the structure of another example communication system ~~according to a modification example of the same embodiment~~.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The ~~preferable mode for carrying out the~~ present invention shall be described in detail with reference to the attached drawings.

1. Structure of Embodiment

1.1. System Structure

Fig. 1 shows the structure of a communication network system of the present embodiment.

~~This~~The communication network system comprises at least one MS (Mobile Station) 1, at least one BS (Base Station) 2, at least one PPM (Packet Processing Module) 3,

and at least one GWS (GateWay Server) 5. At least one ~~,~~ CPS (Content Provider Server) 8 is connected to the GWS 5 via the Internet ~~internet~~ 6 or a dedicated line 7. In addition, at least one ~~and~~ M-SCP (Mobile Service Control Point) 9 is connected with the GWS 5.

~~———~~BS 2, PPM 3, GWS 5, M-SCP 9 and the interconnecting communication paths ~~lines for connecting the se~~ form a mobile packet communication network 10.

MS 1 is a terminal device which utilizes ~~receives~~ packet communication services of the mobile packet communication network 10. In addition to wirelessly communicating with ~~being connected to~~ the mobile packet communication network 10 shown in Fig. 1, the MS 1 ~~is connected to~~ may also wirelessly communicate with a mobile telephone network ~~which is~~ (not shown). ~~, whereby it is~~ The MS1 may therefore also be capable of receiving ~~a~~ mobile telephone service.

Fig. 11 shows an example of the outward appearance of the MS 1 and ~~a~~ example screens displayed on the MS 1. The MS 1 ~~has~~ may include an audio input/output portion (not shown) for the user to perform audio communications. In addition, the MS 1 may include a radio portion for performing wireless radio communications with BS 2 (Fig. 1~~neither are shown~~). Further, the MS 1 may include ~~,~~ an information display portion 1a. The information display portion 1a may include~~be comprising~~ a liquid crystal panel or the like.

An~~,~~ ~~an~~ operating portion 1b may also be included in the MS 1 for performing information input operations such as number entry or character input. The MS 1 also includes~~,~~ ~~and~~ an internal microcomputer for controlling these portions. Additionally, the MS 1 contains software that may be generally referred to as a browser for viewing

document ~~data~~ data ~~(a so-called browser)~~. The ~~This~~ browser is software for displaying a dialog screen based on data in a ~~HTML~~ content format such as HTML data format. The data (hereafter referred to as HTML data) may be supplied from the CPS 8. The CPS 8 may be operated ~~possessed~~ by a content providing business to communicate content over ~~via~~ the mobile packet communication network 10.

The MS 1 may display~~s~~ for the user various types of information on the information display portion 1a utilizing ~~in accordance with~~ the above-mentioned browser. An ~~example, and provides this information to the user. This information~~example information display portion 1a can display 8 (characters) × 6 (lines) of information. In other examples, ~~(~~it is possible to have more than 8 characters horizontally and more than 6 lines vertically, depending on the area of the information display portion 1a and the character size~~)~~.

During operation ~~Next~~, ~~an example of use of~~ the MS 1 may perform a variety of functions and/or provide a variety of data. For example, ~~shall be explained with reference to Fig. 11.~~

~~First,~~ when the user pushes ~~the~~ an "information" key on the operating portion 1b, an initial screen 11A may ~~which~~ provide~~s~~ the user with information relating to a weather forecast. The initial screen 11A is displayed on the information display portion 1a. By operating a jog dial key 1c ~~in the center of the MS 1~~, the user can select from a weather forecast menu of "1"-"6 ~~5~~" in the initial screen 11A.

~~That is, i~~If, for example, the user selects "1", a screen 11B showing today's weather is displayed in the information display portion 1a.

If the user selects "2", then a screen 11C showing a

weekly weather forecast is displayed on the information display portion 1a. If the user selects "5", then a weather message submenu screen 11D is displayed. The weather message submenu screen 11D may be used to ~~select~~, ~~from which it is possible to obtain information~~select information such as a rainfall alarm or a quick weather report. Furthermore, if the user selects "6", then a world weather forecast screen 11E is displayed.

~~In this way,~~ ~~text~~Text-based information ~~is~~ may therefore be displayed on the information display portion 1a under control of the browser. The text-based information may be presented in a form that is easy for the user of the MS 1 to see and control.

In Fig. 1, the BS 2 may be ~~are~~ positioned according to a wireless radio zone. ~~s which divide the ground e.g. into areas having a~~ The wireless radio zone provides a communication area, such as a geographic area with a determined radius ~~of~~ such as about 500 meters. A BS 2 may ~~,~~ ~~and~~ perform radio communications with one or more MS 1 that are present in the wireless ~~these~~ radio zones~~.~~ In the mobile packet communication network 10, a plurality of the BS 2 may be geographically positioned to form a plurality of wireless radio zones.

The PPM 3 is a computer-~~-~~based system ~~provided~~ that may operate in a packet subscriber switching station. The PPM 3 is capable of accommodating a plurality of BS 2. The PPM 3 may ~~, which~~ receives~~~~ packet switching requests from the MS 1~~,~~ via the BS 2. ~~and~~ In addition, the PPM 3 may relays~~~~ packet switching within ~~in~~ the mobile packet communication network 10.

The GWS 5 is a computer-based system that may operate ~~provided~~ with a mobile packet gateway switching station. The GWS 5 may ~~for~~ interconnect~~ing~~ the mobile packet

communication network 10 with another network such as the ~~i~~Internet 6. As shall be explained ~~below~~later, ~~this~~ the GWS 5 may also maintain a wireless communication ~~link~~ path (a radio-oriented interval) between the ~~is for connecting a radio oriented interval from the~~ MS 1 and the GWS 5. In addition, a wireline communication ~~link~~ path (a wire-oriented interval or landline communication ~~link~~ path) may be maintained by the GWS 5 between the GWS 5 and the ~~to itself and a wire oriented interval from itself to the~~ CPS 8. Accordingly, the GWS 5 operates as a relay between the MS 1 and the CPS 8. Additionally, a plurality of the GWS 5 may form a server group. A proxy server may also be included in the server group. Further, the GWS 5 may ~~and performs~~ perform various types of control to enable packet communications between the MS 1 and CPS 8.

Enabling packet communications involves translation ~~by absorbing differences~~ between ~~the simplified protocol (hereafter called TL,~~ a first communication protocol and a second communication protocol. The first communication protocol is a simplified protocol hereafter referred to as "simplified protocol TL" or "TL". The simplified protocol TL is used in wireless communication ~~links~~ paths within wireless communication ~~networks(~~ networks (radio-oriented interval). The second communication protocol is a server based network communication protocol such as TCP. The second communication protocol is used in wireline communication ~~links~~ paths within wireline (or landline) networks (wire-oriented interval) and is hereafter referred to as "TCP/IP protocol." ~~) used in the radio oriented interval and TCP which is the protocol in the wire-oriented interval.~~

~~Additionally, a plurality of the GWS 5 are provided to form a server group, with a proxy server also contained~~

~~in this server group.~~

The CPS 8 is a server-based system that may be operated by ~~the~~ a content provider business. The CPS 8 may supply ~~, and supplies~~ the GWS 5 with content. The content may ~~the information to~~ be provided to the users of the MS 1 in a content format such as HTML data format. The content may be provided via the Internet ~~internet~~ 6 or a dedicated line 7.

~~Additionally~~ In addition, the GWS 5 may include ~~itself contains~~ a server for the mobile packet communication network 10 ~~business~~ to provide content to the MS 1.

The M-SCP 9 may manages ~~s~~ subscriber information and performs ~~s~~ processing relating to packet registration. When ~~when~~ packet communications begins, packet registration may be performed by the M-SCP 9. When packet communication ends, ~~as shall be explained, and~~ packet deregistration may be performed by the M-SCP 9. ~~when packet communications end.~~

~~Billing~~ information for the packet communications ~~are~~ may be recorded in the PPM 3 and the GWS 5~~,~~. The billing information may be ~~and~~ transferred at a predetermined timing to a billing center such as a call toll accounting ~~center~~center ~~which is~~ (not shown).

1.2. Protocol Structure

In the above-described communication system, the devices employ ~~the~~ protocol structures ~~described below~~ in order to perform data communications between the MS 1 and the CPS 8.

Figs. 2 and 3 express schematically ~~the~~ example protocol structures of the present embodiment based on an OSI layer model. ~~Here,~~ Fig. 2 shows a protocol structure for a case where information is received from the CPS 8 by

the mobile station (MS 1). ~~alone, and~~ Fig. 3 shows a protocol structure for a case where information is received from the CPS 8 by ~~in a structure where~~ an external device 11, such as a portable information terminal or car navigation device, that is coupled with~~attached to~~ the MS 1~~is associated therewith.~~

In the example protocol structures shown in Figs. 2 and 3, the left side of the GWS 5, i.e. the PPM 3 and the MS 1 (and external device 11) are in wireless communication or in the radio-oriented data communication interval. ~~, wherein With~~In a wireless communication ~~link~~path, a radio communication protocol and the simplified protocol TL of the present embodiment are used. On the other hand, the right side of the GWS 5, i.e. up to the CPS 8 is a wire line communication ~~link~~path or the wire-oriented communication interval. ~~, wherein~~ In the wire line communication ~~link~~path, the general-purpose protocol TCP/IP (second communication protocol) is used.

~~Thus, t~~The example protocol structure shown in Figs. 2 and 3 shall now be described in sequence from the bottom layers to a top layer based on ~~an~~ the OSI layer model.

1.2.1. First Layer (Physical Layer)

In Figs. 2 and 3, L1 indicates a physical layer protocol.

~~———~~In the physical layer protocol of the wire-line communication ~~link~~path (wire-oriented interval), the ~~used~~ frequencies used, transmission power, modulation method, access method and other wire line-related communication parameters~~the like~~ are defined. The wire line-related communication parameters are defined in order to ensure that the transmission of bit sequences is performed using communication lines composed of physical media such as dedicated lines, public telephone lines or ISDN.

On the other hand, in the physical layer protocol of the wireless communication ~~link~~path (radio-oriented interval), the packet communication channels are defined on the basis of the channel structure of the ~~PDC system, and in particular,~~ mobile packet communication network 10 (FIG. 1), such as a personal digital communication (PDC) system. ~~t~~The arrangement/structure of physical channels for packet communication, ~~and~~ the signal coding method and signal transmission method for transmitting signals using the physical channels for packet communication are defined.

1.2.2. Second Layer (Data Link Layer)

In Figs. 2 and 3, L2 indicates a data link layer protocol.

~~———~~In the data link layer protocol of the wire-line communication ~~link~~path (wire-oriented interval), the procedures and interfaces for performing transparent and highly reliable data transmissions between nodes are defined. The procedures and interfaces may be defined using bit sequence transmission functions provided in the physical layer. Data links are established using PPP as the protocol of this data link layer.

On the other hand, in the data link layer protocol of the wireless communication ~~link~~path (radio-oriented interval), LAPDM (Link Access Procedure for Digital Mobile channel) is used between the MS 1 and PPM 3. ~~This~~ The LAPDM is ~~one~~ used for physical control channels and physical communication channels with functions added to perform packet communications efficiently so as to enable use on physical channels for packet communications. Furthermore, in the case of Fig. 3, an LAPB (Link Access Procedure Balanced) is used between the MS 1 and the external device 11.

1.2.3. Third Layer (Network Layer)

The network layer protocol in the wireless communication ~~link~~path (wire-oriented interval) is composed of an IP (Internet Protocol). This IP performs routing and supplies HTML data transmitted from the CPS 8 to the GWS 5 via the ~~i~~Internet 6.

~~———~~Additionally, in the wireless communication ~~link~~ path (radio-oriented interval), PMAP (Packet Mobile Application Part) ~~is~~ may be used between the PPM 3 and GWS 5. ~~This~~ The PMAP is defined as a ~~signal~~ message format for transmitting and receiving user packets between nodes in a PDC-P network.

The network layer protocol for communications between the MS 1 and the PPM 3 may be~~is~~ composed of RT (Radio frequency Transmission management), MM (Mobility Management) and CC (Call Control).

~~———~~Here, RT ~~achieves~~ performs functions relating to management of radio resources (including management of physical channels for packet communications). ~~including~~ In addition, such functions as selection of radio zones and ~~as~~ setting, maintenance, switching and disconnection of radio channels are performed by RT. ~~,~~ MM ~~achieves~~ performs functions relating to mobile station (MS 1) movement support. ~~including~~ The functions include position registration and identification. ~~functions, and~~ CC ~~achieves~~ performs functions relating to channel call connection control. ~~including s~~Such functions ~~as~~ include setting, maintenance and release of calls. The detailed operations of these network layer protocol functions are described in "Digital Car Telephone System Standards RCR STD-27F".

~~———~~These functions work cooperatively to perform such control as simultaneous standby control, communication initiation control, packet transfer control, channel switching control, periodic registration control and communication termination control.

1.2.4. Fourth Layer (Transport Layer)

The transport layer protocol of the wire-line communication ~~link~~path (wire-oriented interval) is composed of TCP. ~~This~~ The transport layer protocol is for supplying HTML data transmitted from the CPS 8 to the GWS 5 via the ~~i~~Internet 6.

~~Additionally, t~~The transport layer protocol is also for communications between the MS 1 and GWS 5 ~~in~~ over the wireless communication ~~link~~path (radio-oriented interval). The transport layer protocol over the wireless communication ~~link~~path is composed of the simplified protocol TL. ~~This~~ The TL provides a connection-type service for performing highly reliable end-to-end communications~~, making~~ that make communications by virtual circuits possible. As a result, higher level applications can provide dialog-type services as if a physical point-to-point link has been established with a communication partner (this is known as a "logical connection"). ~~Additionally, this~~ The TL can set up a plurality of logical connections simultaneously. The communication protocol of the mobile packet communication network 10 (FIG. 1) is composed in such a way that the TL directly resides on the bearer of the mobile packet communication network 10.

1.2.5. Fifth Layer (Session Layer)

~~In~~ Over the wire-line communication ~~link~~path (wire-oriented interval), HTTP ~~is~~ may be used for browser display. In addition, ~~and~~ SMTP ~~is~~ may be used for electronic mail distribution. HTTP and SMTP may be used on the session layer and presentation layer between the GWS 5 and the CPS 8.

~~———~~Between the MS 1 and the GWS 5, communications ~~are~~ may be performed using HTTP by means of a virtual circuit ~~to be~~that is explained ~~below~~later. ~~Additionally~~In addition,

in the application layer, data communications are performed between the MS 1 ~~having~~ operating a browser and the CPS 8 possessing data of various formats such as plain text, HTML, GIF, and the like.

1.2.6. Sixth Layer (Presentation Layer)

~~Between the MS 1 and GWS 5, t~~The sixth layer ~~is composed of~~ may include HTTP as an I~~i~~nternet work-dedicated protocol~~,~~ between the MS 1 and the GWS 5. ~~between~~ Between the GWS 5 and the CPS 8, ~~it is composed of~~ the sixth layer may include HTTP/SMTP protocols.

1.2.7. Seventh Layer (Application Layer)

The application layer of the MS 1 is composed of a browser having the function of ~~internet~~ Internet browsing software.~~,~~ ~~and~~ ~~t~~The application layer of the CPS 8 ~~which provides the user of the MS 1 with various information is composed of~~ includes data such as plain text, HTML, GIF, and the like. As previously discussed, the CPS 8 operates as a server to provide the user of the MS 1 with various content.

2. Operation of the Embodiment

The overall operating sequence of a communication system including the wire-line communication ~~link~~path (wire-oriented interval) and wireless communications ~~link~~path (radio-oriented interval) employing a protocol structure of this type shall be explained for the case of performing packet communications. In the following description, the structures of the packets exchanged in the wireless communication ~~link~~path (radio-oriented intervals) shall be referred to as the "occasion demands." In addition, it should be understood that each of the packets are transmitted in the form of a signals~~,~~ that are each messages.

2.1. Operating Sequence for Packet Registration

When a user presses the "information" key in MS 1, the operating sequence for packet registration shown in Fig. 4 is executed.

~~First,~~At S100, a packet communication registration request is issued from the MS 1 side toward the PPM 3 in the form of a message(or signal) ~~(S100)~~. Upon receiving ~~this~~the registration request, the PPM 3 sends the GWS 5 a ~~signal~~ message requesting readout of packet origination information at S101. The packet origination information ~~indicating~~ indicates whether or not the packet originator is a packet subscriber ~~(S101)~~. ~~This~~ The packet origination information readout request ~~signal~~ message is transmitted through the GWS 5 to the M-SCP 9 ~~(S102)~~.

The M-SCP 9 searches for subscriber information corresponding to ~~the~~ an originator ID ~~contained~~ included in the packet origination information readout request ~~signal~~ message to determine whether or not the user of MS 1 is a packet service subscriber, and sends out a packet origination information readout response ~~signal~~ message at ~~(S103)~~. ~~Then~~At S104, ~~this~~ the packet origination information readout response ~~signal~~ message is transmitted through the GWS 5 to the PPM 3 ~~(S104)~~.

~~Upon~~ receiving ~~this~~the packet origination information readout response message, the PPM 3 sends the MS 1 a packet identification request ~~signal~~ message at ~~(S105)~~. At S106, a packet identification response ~~signal~~ message ~~with respect~~ in response to ~~this~~ the packet identification request signal is returned from the MS 1 to the PPM 3 ~~(S106)~~.

~~Next, a~~A packet communication registration request ~~signal~~ message requesting registration of packet communications is transmitted from the PPM 3 through the

GWS 5 to the M-SCP 9 at ~~(~~S107~~→~~ and S108~~)~~. At S109, t~~T~~he M-SCP 9 performs registration for initiating packet communication between the MS 1 and the ~~radio transmission~~wireless communication system, and returns a packet communication registration response ~~signal~~ message to the GWS 5 ~~(S109)~~. The~~n, this~~ packet communication registration request ~~signal~~ message is transmitted from the GWS 5 to the PPM 3 at ~~(~~S110~~)~~.

Upon receiving ~~this~~ the packet communication registration response ~~signal~~ message, the PPM 3 sends a channel connection request ~~signal~~ message requesting channel connection to the GWS 5 at ~~(~~S111~~)~~. ~~Receiving this~~At S112, the GWS 5 receives the channel connection request message~~signal~~ and sends a channel connection request message~~signal~~ to the CPS 8. ~~(S112), and t~~The CPS 8 returns a channel connection response message ~~signal~~ at ~~(~~S113~~)~~.

~~———~~Upon receiving the channel connection response message~~signal~~, the GWS 5 sends the PPM 3 a channel connection ~~request~~ response message ~~signal~~ at ~~(~~S114~~)~~.~~,~~ ~~and~~At S115, the PPM 3 sends the MS 1 a packet communication registration response message ~~signal (S115)~~.

2.2. Operating Sequence during Packet Communications

When ~~this~~ the sequence of packet communication registration procedures ends, an initial screen such as the example shown in the previously ~~mentioned~~ discussed Fig. 11 is shown in the information display portion 1a of MS 1. ~~Then, when t~~The user may then operate~~s~~ ~~a~~the jog dial key 1c and selects a menu number from the initial screen.~~,~~ Ppacket communications may ~~are~~ then commenced to display the content of the homepage at the URL linked to that menu number on the information display portion 1a.

Fig. 5 shows ~~the~~ an example operating sequence during packet communications.

~~First~~At S200, the MS 1 sends out a first packet (TL-OpenReq packet)~~.; "first packet" in the claims)~~ ~~containing~~ The first packet includes a connection setup request message (Open Request), the URL of the homepage which is to be accessed, and an HTTP-Get method. The HTTP-Get method is requesting transfer of the data required to display the content of the homepage on the information display portion 1a of the MS 1~~(S200)~~.

Fig. 8 shows the structure of ~~the~~ an example TL-OpenReq packet sent when requesting connection setup in t he example of FIG. 5. In this packet, the field ~~indicating the type of message contains~~ identified as "message type" includes information indicating that the message type is an "Open Request" message.~~, and~~ ~~the~~ The field ~~for~~ identified as "data" contains data for the HTTP-Get method including the above-mentioned URL. The "logical number" field contains identification numbers for identifying the end-to-end connection established between the MS 1 and the GWS 5. The simplified protocol TL in the wireless communication ~~link~~path (radio-oriented interval) enables a plurality of simultaneous logical connections.~~,~~ ~~each~~ Each logical connection ~~being~~ is indicated ~~identified by means of this~~ in the field identified as "logical number." ~~This~~ The logical number field is set on the mobile station side (MS1).

~~Additionally, the~~ The fields ~~indicating~~ identified as "communication parameters" contains the data length and the ~~number of units~~amount of data that ~~capable of being received at once by~~ the MS 1 can receive in one packet.~~, as well as~~ In addition, information such as timer values for the case where retransmission is to be performed may be included in the communication parameters fields. ~~That is,~~

~~the~~ The MS 1 may store ~~houses~~ information relating to its own capabilities in the communication parameter fields of the transfer packet to be sent to the wireline network side.

~~This~~ As shown in FIG. 5, the TL-OpenReq packet may be~~is~~ sent through the PPM 3 to the GWS 5 at ~~(~~S201~~)~~. ~~Upon receiving this, the~~ The GWS 5 returns ~~a TCP acknowledgment response packet and~~ a packet containing an acknowledgement response message (~~Open Acknowledge~~ TL-OpenAck) ~~with respect~~ to the MS 1 ~~TL Open Request is returned to~~ through the PPM 3 (~~S202, S203~~, s205).

~~That is~~More specifically, on the wireline network side, a logical connection setup request message is received. ~~,~~ ~~the~~ The communication parameter information for the MS 1 side is analyzed. ~~, and~~ ~~the~~ The communication parameters ~~at logical connection setup~~ are determined and sent out, together with the acknowledgment response message (Open Acknowledge).

~~In this way, with~~ With the simplified protocol TL, the capabilities ~~of the partner side~~ (the above-mentioned communication parameter values) of the MS 1 and the GWS 5 (the partner sides) are negotiated before setting up the logical connection and prior to data exchange. ~~,~~ ~~so that~~ Thus, resources are used efficiently, and capacity control is performed by traffic gradients.

~~Then, a~~A logical connection is then established between the MS 1 and the GWS 5 by means of these operations, and the exchange of packet data is completed.

Fig. 9 shows the structure of an example TL-OpenAck packet sent as an acknowledgement response to a connection setup request message in the example of FIG. 5. In ~~this~~ the TL-OpenAck packet, the field ~~indicating~~ identified as the "message type" contains information indicating that it is an "Open Acknowledge" message. ~~, and~~ ~~the~~ The field

identified as "logical number" ~~field~~ contains logical numbers designated at the time of the connection setup request.

~~Then, this~~Referring again to FIG. 5, the TL-OpenAck packet is transferred to the mobile station side (MS 1) at ~~(S205)~~., ~~and the TCP acknowledgment response packet is transferred from the PPM 3 to the GWS 5 (S204)~~.

On the other hand, the following ~~type of~~ exchange occurs between the GWS 5 (which has received the TL-OpenReq packet) and the CPS 8 based on the ~~normal~~ TCP operating sequence.

~~First,~~At S206, in order to establish a connection between the GWS 5 and the CPS 8, a segment to which a SYN flag has been set is sent from the GWS 5 to the CPS 8. ~~(S206), and~~ ~~as~~ As an acknowledgment response to indicate that the segment has been received, a segment with an SYN flag and an ACK flag is returned from the CPS 8 to the GWS 5 at ~~(S207)~~. ~~Then~~At S208, a segment having an ACK flag is sent from the GWS 5 to the CPS 8 ~~(S208)~~. A connection is established between the GWS 5 and the CPS ~~server~~ 8 by means of ~~this~~ a Three Way Handshake procedure that is part of the TCP.

~~Next~~At S209, an HTTP-Get segment containing the URL of the target homepage (obtained from MS 1 in step S201) is transmitted from the GWS 5 to the CPS ~~server 5~~8. ~~(S209), and~~ ~~the~~ The CPS 8 returns an acknowledgment response signal indicating that the HTTP-Get segment has been received ~~to~~ by the GWS 5 at ~~(S210)~~.

~~Then~~At S211, an HTTP-Res segment containing data from the homepage ~~in~~ of CPS 8 as designated by the URL is transmitted from the CPS 8 to the GWS 5. ~~(S211), and~~ ~~a~~ A segment with an ACK flag indicating that the HTTP-Res segment has been received is returned from the CPS 8 at

~~(~~S212~~)~~.

When data transfer by the HTTP-Res segment ends, the ~~following type of~~ connection termination process is performed.

~~First~~At S213, a segment set up with a FIN flag is sent from the CPS 8 to the GWS 5. ~~(S213).~~ The GWS 5 returns an acknowledgment response segment indicating that ~~this~~ the segment has been received at ~~(~~S214~~)~~. ~~Then~~At, this time, a similar connection termination process is performed from the GWS 5 at ~~(~~S215~~,~~ and S216~~)~~.

By means of this sequence composed of ~~the 11 steps of steps~~ S206-S216, data from the homepage ~~in~~ of the CPS 8 is supplied to the GWS 5.

~~Next, a~~A packet (TL-DATA packet) containing data from the homepage ~~in~~ of the CPS 8 previously supplied to the GWS 5 is transferred to the PPM 3 at ~~(~~S217~~)~~.

~~In~~ Fig. 10, ~~this~~ an example TL-DATA packet is indicated as packet 10A, and its structure is shown. In ~~this~~ packet 10A, the field ~~indicating~~ identified as the "message type" contains information indicating that the message type is a "Data" message. ~~, and~~ ~~the~~ The fields identified as "data" ~~field contains~~ includes the data from the homepage ~~in~~ of the CPS 8.

Referring again to FIG. 5, ~~A TCP acknowledgment response packet indicating that this packet has been received is returned from the PPM 3 to the GWS 5 (S218). Then,~~ the TL-DATA packet transferred to the PPM 3 is then transferred to the MS 1 at ~~(~~S219~~)~~. As a result, data from the homepage ~~designated~~ selected by the user is transferred to the MS 1. ~~, and~~ ~~the~~ The content corresponding to the menu number selected from the initial screen 11A (FIG. 11) by the user is displayed on the information display portion 1a.

Then~~, the~~ MS 1 returns an acknowledgment response packet (TL-DATA Ack ~~packet~~) to the PPM 3 indicating that the TL-DATA packet has been received ~~to the PPM 3~~ at ~~(~~S220~~)~~.

~~———~~In Fig. 10, ~~this~~ the TL-DATA Ack packet is shown as packet 10B, and its structure is shown. In ~~this~~ packet 10B, the field ~~indicating~~ identified as ~~the~~ "message type" ~~contains~~ includes information indicating that the message type is "Data Acknowledge".

Referring again to FIG. 5, t~~T~~he TL-DATA Ack packet returned to the PPM 3 is transferred to the GWS 5 at ~~(~~S221~~)~~.~~, and a TCP acknowledgment response packet indicating that this~~ the TL-DATA Ack packet has been received is returned to the PPM 3 (S222).

~~While the~~ The ~~example~~ above-explained ~~above~~ example is one where~~in~~ data transfer ends after a single packet transferred from the CPS 8 to the MS 1.~~,~~ ~~in~~ In actual practice, the sequences between the PPM 3 and GWS 5 (S217, ~~S218,~~ S221~~, S222~~) and the sequences between the MS 1 and PPM 3 (S219, S220) are repeatedly performed in accordance with the amount of data supplied from the CPS 8. That is, if the amount of data supplied from the CPS 8 is 3 times the maximum amount of data capable of being received ~~at once~~ in one packet on the MS 1 side, then the data is divided and transferred to the MS 1 side in 3 ~~divisions~~packets.~~, and~~ ~~the~~ The processes of steps S217, S218, S221 and S222, and steps S219 and S220 are therefore performed 3 times.

2.3. Operating Sequence at Packet Communication Termination

Fig. 6 shows an example of the operating ~~sequence~~ process at the time of packet communication termination.

~~———~~First, a ~~signal which~~ message ~~requests~~ requesting

deregistration from packet communications is transmitted from the MS 1, through the PPM 3 and GWS 5 to the M-SCP 9 at ~~(~~S300~~,~~ ~~and~~ S301 ~~and~~ S302~~)~~. At S303, t~~T~~he M-SCP 9 deregisters MS 1 from packet communications, and sends a packet communication deregistration ~~signal~~ response message ~~(S303)~~. ~~This~~ The packet communication deregistration ~~signal~~ response message is transmitted via the GWS 5 and PPM 3 to the MS 1 at ~~(~~S304 ~~and~~ S305~~)~~. ~~, and upon receiving it~~ At S306, the MS 1 sends the PPM 3 a response ~~signal with respect to~~ message acknowledging receipt of the packet communications deregistration ~~signal~~ response message ~~(S306)~~.

~~Next, the~~The PPM 3 sends the GWS 5 a ~~signal~~ message requesting disconnection of the channel at ~~(~~S307~~)~~. ~~, and~~At S308, the GWS 5 sends the CPS 8 the channel disconnection request ~~signal~~ message ~~(S308)~~. Upon receiving ~~this~~ the channel disconnection request message, the CPS 8 sends the GWS 5 a channel disconnection response ~~signal~~ message at ~~(~~S309~~)~~. ~~, and~~ At S310, the GWS 5 sends the PPM 3 a channel disconnection response ~~signal~~ message ~~(S310)~~, thus ending the ~~sequence~~ process performed at packet communications termination.

3. Effects of the Embodiment

(1) ~~In this way, b~~By comparing the conventional sequence using PPP, IP and TCP (shown in Fig. 15) with the sequence using TL between the MS 1 and GWS 5 (shown in Fig. 5) ~~of the present embodiment~~, it is possible to largely reduce (to about 1/3) the number of messages (signals) exchanged between the transmitting side and the receiving side. ~~, and to smoothly perform~~ As a result, data communications may be smoothly performed even if the hardware ~~specs~~ performance (CPU processing power, memory capacity, etc.)

of the MS 1 are ~~not very high~~ relatively low.

(2) Additionally, as shown in Fig. 7, the structure of the packet 7B transferred ~~in the present embodiment~~ with the ~~simplified~~ protocol TL is considerably simplified. That is, in communications by the simplified protocol TL, each packet is composed of a header of approximately 10 bytes (called the TL header) and application data (e.g. about 500 bytes, expandable to a maximum of about 1400 bytes). Consequently, the header size is largely reduced (to about 1/5) in comparison to conventional packets 7A using TCP/IP. As a result, the amount of transferred data is reduced and the communication ~~cost is~~ time and bandwidth requirements are ~~also~~ lowered.

4. Examples of Modifications

The present invention is not restricted to the above-described embodiments, and various modifications such as the examples given below are possible.

(1) ~~While d~~Data communications downstream with respect to the network ~~was~~ have been previously described ~~in the present embodiment~~ from the viewpoint of the user of a mobile station (MS 1) receiving data distributions from a CP server (CPS 8). ~~,~~ ~~I~~It is also possible to transfer data according to the previously described ~~communication simmplified~~simplified protocol ~~(TL)~~ ~~described in the present embodiment~~ in data communications upstream. That is, data communications by TL are possible in cases where electronic mail is to be transmitted to a partner terminal connected to the ~~internet~~ Internet.

(2) The previously described ~~communication~~ simplified protocol (TL) ~~described in the present embodiment~~ is ~~no more than a single~~one example of a simplified protocol. ~~It can be a~~Any protocol that does not have a relatively high

~~signal~~ number of messages ~~such~~ as ~~the~~ in conventional TCP/IP, ~~is~~ may be connected to the communication partner by a virtual circuit at the transport layer level, and allows for connection-type communications.

(3) The structure of the packets and content of the information elements described in the present embodiment are only examples. ~~,~~ ~~and~~ Therefore these structures and content may be of any type which allows the header size to be made smaller, and enables smooth data communications between the user terminal (MS 1) and the relay apparatus (CPS 8).

(4) The format of the data distributed from the CP server does not need to be HTML. ~~, and~~ ~~o~~Other formats may be employed. For example, if the distributed information is only text data, then it does not have to be a data format which uses browser-compatible tags such as HTML.

(5) The GWS 5 can be composed of a plurality of devices, ~~such as~~ to spread the load and traffic on the GWS 5. For example, as shown in Fig. 16, it can be separated into an M-PGW (Mobile Message-Packet Gateway Module) 11 and a GWS 13. ~~, such that~~ In this example, the GWS 13 performs relay processes between the mobile packet communications network 10 and external communication paths. ~~, and~~ ~~t~~The M-PGW 12 performs other processes. ~~Additionally~~ In addition, it is possible to provide a plurality of M-PGW 11 and connect each M-PGW 11 to the GWS 13, so as to spread the load and traffic on each M-PGW.

While the present invention has been described with reference to specific exemplary embodiments, it will be evident that various modifications and changes may be made to these embodiments without departing from the broader spirit and scope of the invention as set forth in the claims. Accordingly, the specification and drawings are to

be regarded in an illustrative rather than a restrictive sense.

ABSTRACT OF THE DISCLOSURE

The present invention has the purpose of providing technology capable of efficiently transmitting data when performing data communications between a mobile station and a server apparatus.

~~In the present invention, a~~ A simplified protocol TL is employed on the transport layer instead of TCP/IP. The simplified protocol TL is used as the communication protocol on ~~the~~ a wireless communication ~~link~~path (radio-oriented interval) between an MS (Mobile Station) 1 and a GWS (GateWay Server) 5. ~~which~~The simplified TL protocol is utilized to relay~~s~~ data communications between the MS 1 and a CPS 8 (Content Provider Server). ~~Additionally, the headers of the packets for data transfer according to TL are made up of about 10 bytes. By doing so, the traffic between the MS 1 and GWS 5 is decreased an d the overhead is reduced in comparison to when TCP/IP is employed, thus improving the response of the data communications.~~ The response of data communications is therefore improved by a decrease in traffic between the MS 1 and the GWS 5 and reduction in overhead in comparison to when TCP/IP is deployed. As a result, the user can ~~comfortably~~ efficiently access contents ~~provided by the CPS 8 on~~ over the ~~internet~~ Internet via a wireless communication ~~link~~path. ~~radio oriented interval which~~ Efficient access may occur even where the wireless communication ~~link~~path has ~~a~~ low data transmission capacity in comparison to a wire-~~oriented~~line ~~interval~~communication ~~link~~path. In addition, efficient access may occur where the user is using an MS 1 which has insufficient data processing power to ~~employ~~deploy TCP/IP.